

but their number and the number of subdivisions have greatly increased. In 1822, when Phillips and Conybeare wrote their 'Geology of England and Wales,' twenty-three so-called formations were recognised, whereas now thirty-eight such are established, and these are divided into about 120 subdivisions, each characterised by some peculiarity of structure or of fauna. Palæontology as a separate science was not then known; structural and physical geology had chiefly occupied attention; but the study of organic remains has since advanced with such rapid and vigorous strides that the older branch was until lately in danger of being neglected and distanced.

"At that time the number of species of organic remains in Great Britain which had been described amounted only to 752, whereas now the number amounts to the large total of 13,276 species.

"Some idea of the extent and variety of the past life of our globe may be formed by comparing these figures with the numbers of plants and animals now living in Great Britain. Excluding those classes and families, such as the naked mollusca and others, which from their soft and gelatinous nature decay rapidly, and so escape fossilisation, and insects\*—the preservation of which is exceptional—the number of living species amounts to 3,989, against 13,183 extinct species of the same classes.

"Thus, while the total number of those classes of vertebrate and invertebrate animals and plants represented in a fossil state, and now living in Great Britain, is only 3,989, there formerly lived in the same area as many as 13,276 species, so that the fossil exceed the recent by 9,287 species. It must be remembered also that plants are badly represented, for, owing to their restricted preservation, the fossil species only number 823 against 1,820 recent species. Birds are still worse represented, as only eighteen fossil species occur against 354 recent species.

"But the multiplicity of British fossils, however surprising as a whole, has to be viewed in another and different light. The large total represents, not as the recent species do, the life of one period, but the sum of those of all the geological periods. Geological periods, as we construct them, are necessarily arbitrary. The whole geological series consists of subdivisions, each one of which is marked by a certain number of characteristic species, but each having a large proportion of species common to the subdivisions above and below it. These various subdivisions are again massed into groups or stages, having certain features and certain species peculiar to them and common throughout, and which groups are separated from the groups above and below by greater breaks in the continuity of life and of stratification than mark the lesser divisions. As these on the whole severally exhibit a distinct fauna and flora, we may conveniently consider them as periods, each having its own distinctive life, and the number of which in Great Britain we have taken approximately at thirty-eight.

"The number of species common to one period and another varies very greatly, but taking the average of the sixteen divisions of the Jurassic and Cretaceous series, of which the lists were, with a portion of those of the older series, given a few years since by Prof. Ramsay,† we may assume that about thirty per cent. of the organic remains pass from one stage to another.

"Dividing the 13,276 fossil species among the thirty-eight stages, or omitting the lower stages and some others, and taking only thirty, we thus get an average of 442 species for each; and, allowing in addition for the number common to every two periods, we obtain a mean of 630 species as the population of each of the thirty periods, against the 3,989 species of the present period. On this view the relative numbers are therefore reversed.

"This gives a ratio for the fauna or flora of a past to that of the present period of only as 1 : 6·3. But it must be remembered that probably the actual as well as the relative numbers of the several classes *inter se* in each and all of these several formations, varied greatly at the different geological periods. Still we have no reason to suppose but that during the greater part of their life of one form or another was as prolific, or nearly so, in the British area then as at the present day, and we may thus form some conception of how little relatively, though so much really, we have yet discovered, and of how much yet remains to be done before we can re-establish the old lands and seas of each successive period, with their full and significant populations. This we cannot hope ever to succeed in accomplishing fully, for

decay has been too quick and the rock entombment too much out of our reach ever to yield up all the varieties of past life; but although the limits of the horizon may never be reached, the field may be vastly extended; each segment of that semicircle may yet be prolonged we know not how far; and it is in this extension—in the filling up of the blanks existing in the life of each particular period—that lies one great work of the future."

(To be continued.)

## NOTES

It is perhaps too much yet to expect any allusion to the interests of science in that very *staccato* composition, a Queen's Speech. The next best thing to this, however, occurred last Friday, when Lord Rayleigh, the seconder of the Address, very courageously pointed out the omission from the Speech of any allusion to an event "which had excited some public interest of a non-political character." His lordship referred to the recent Transit of Venus, in which the astronomers of this country had taken a part, but by no means, he thought, "too large a part." We confess that on this point we quite agree with Lord Rayleigh; indeed, we think he has stated the case, as against England in this matter, with remarkable mildness. But this is a mere detail compared with what followed. Lord Rayleigh said "he could not pass from astronomy without expressing a hope that other sciences of equal philosophical interest and greater material importance might receive more Government recognition than had hitherto been accorded them. It was something of an anomaly that England, whose great prosperity was largely due to scientific invention, should be slow to encourage those whose discoveries were laying the foundations of future progress. It was said, he knew, that these things might be safely left to individual enterprise, but there were fields of investigation in which individuals were powerless. We hope that this emphatic advocacy of the claims of science on Government, by one who has had the honour of being selected to second the Address on the Queen's Speech, augurs favourably for the amount of attention these claims are likely to secure during the forthcoming session.

THE words of Mr. Disraeli on Monday night with regard to University Reform are also very cheering to those who wish to see some decided action taken towards the thorough reform of our Universities. Mr. Disraeli's words were very strong, so strong indeed as to amount to an assurance that Government really means to take into serious consideration this session the Report of the University Commission. "It is our opinion," the Prime Minister said, "that no Government can exist which for a moment maintains that the consideration of University Reform, and consequently legislation of some kind, will not form part of its duty." These words give out no uncertain sound. Mr. Disraeli said, moreover, that when the Report was presented at the end of last session, the Colleges were not assembled. It would be interesting to know whether the Colleges have yet met to consider the Report, and whether they are likely to act on this hint of the Premier and take some internal action—commence the work of reform from within, instead of waiting until they are driven to it by forces from without.

WE are able to give this week the first instalment of an abstract of Prof. Prestwich's lecture in the chair of Geology at Oxford. We have printed it in small type, in order to be able to give as much as possible of an address which, our readers will see, is likely to mark an important stage in the history of geological science. The address will shortly be published in a separate form.

THE Arctic Committee appointed by the Admiralty, having completed its work and sent in a final report, was dissolved last week. The Committee has got through much work in the way

\* The number of British species of insects amounts to between 10,000 and 11,000.

† Anniversary Addresses for 1863 and 1864. *Quarterly Journal Geological Society*. The tables were computed by Mr. Etheridge.

of ordering clothes and provisions, and making preparations of all kinds, in which it was ably assisted by Dr. Lyall and Mr. Lewis, two old Arctic officers of long experience. The further arrangements will be under the direct supervision of Capt. Nares, who will also assign the special duties to be undertaken by the different officers under his command. Commander Markham, who acquired much experience in ice navigation in 1873, will, it has now been arranged, accompany Capt. Nares in the first ship, and the younger executive officers are the very pick of the service. The medical staff, consisting of four officers, is also composed of men who are quite capable of taking charge of some branches of scientific investigation. One, at least, is a good botanist.

IN our last number, p. 268, is a letter in which the importance of attaching a competent geologist to the expedition is strongly urged. It is, of course, very desirable that, if scientific civilians are attached to the expedition, they should be men who can secure results which could not be equally well secured by any of the officers. As regards botany, the number of known flowering plants in Greenland is about 130, and it is unlikely that they can be largely added to. The point of botanical interest, within the unknown region, is the distribution of genera and species; and what is needed is diligent collection, with careful notes of the localities where the different species are found. This could be perfectly well done by the medical and other officers of the expedition. But to secure satisfactory geological results, a trained geologist, well acquainted with all the Arctic problems, is essential, and it is not likely that any of the officers would have the necessary qualifications. It is, therefore, very important that suggestions such as those of our correspondent last week, and of others who have urged the same views, should have their due weight.

AT the meeting of the Royal Geographical Society on Monday, Admiral Richards read to a large and distinguished audience, including H.R.H. the Prince of Wales, a paper on the proposed route to the Pole for the Arctic Expedition. It was intended at present, he said, that the two vessels should leave Portsmouth about the latter end of May, and, taking the usual route to Baffin's Bay, so endeavour to pass up Smith's Sound. In  $81^{\circ}$  or  $82^{\circ}$  north latitude they would probably separate, and while one would stay exploring the northern coast of Greenland, the other would push still further northwards. Everything, the Admiral was of opinion, had been done to ensure success. After a few remarks on the probable nature of the sea beyond  $82^{\circ}$  latitude, in the course of which he stated that from the violent current which swept southwards from Smith's Sound and through Hudson's Strait, along the coast of Labrador, he inferred that there was no great continent north of Smith's Sound, he concluded by pointing out the advantages that would result from the expedition.

WITH regard to the proposed German Arctic Expedition, the Committee of the Federal Council on Maritime Matters has proposed that the Council should submit the question of sending out a German Arctic Expedition to an Imperial Commission for consideration.

To those who are seeking for detailed information concerning the route of the Arctic Expedition, we would commend an article (with map) by Dr. R. Brown, in the *Geographical Magazine* for February, on Disco Bay, giving a very full idea, derived from personal experience, of the physical and social condition of the West Greenland coast between  $69^{\circ}$  and  $71^{\circ}$  N. lat. The *Magazine* states that Dr. Brown is "the greatest living authority on all scientific questions connected with Greenland." In the forthcoming volume of the "Transactions" of the Geological Society of Glasgow Dr. Brown will have a paper on the Noursoak Peninsula and Disco Island.

MANY influential French papers are circulating the intelligence that Lieutenant Bellot, although he came to London with the authorisation of the French Government, has not been admitted on the staff of the English Arctic Expedition. Strong remarks are made on the supposed selfishness of the British Admiralty.

LIEUT. CAMERON has sent home a map of Lake Tanganyika, from Ujiji to the south end, on a large scale; which represents geographical work of great importance. The work of Burton and Speke and Livingstone on the lake is confined to the portion north of Ujiji; for the voyage made by Dr. Livingstone along the west coast, south of Kasengé Island, was made at a time when he was too ill to make observations. Cameron's exploration is, therefore, a discovery in the true sense, and one of considerable interest, for that young officer has not only carefully delineated the outline of the lake, with all the indentations of the coast and the mouths of rivers, but he has discovered the outlet, and thus solved a great geographical problem. He is himself very cautious in assuming anything without personal inspection, and even yet hesitates to allow that the stream which he found flowing out, and traced for some miles, is really an outlet. He holds it to be possible that it may flow into some swamp or backwater. But there really seems to be little room for doubt on the subject, although Lieut. Cameron is wisely resolved to make a further examination. The river Lukuga flows out of the lake, at the end of a large bay, a short distance south of the Kasengé Island, between which and the outlet is the mouth of the Rogumba, which flows into the lake. The Lukuga, according to the Chief and people who live on its banks, flows from Lake Tanganyika to the river Lualaba. On May 4th Cameron went down the Lukuga for a distance of four miles, and found it to be three to five fathoms deep, and five to six hundred yards wide, but much choked with grass. There was a distinct, but not a rapid current flowing out. We understand Cameron's map of Lake Tanganyika will shortly be published by the Geographical Society.

A VERY interesting paper in the *Geographical Magazine* is on Great Thibet, being an account of a journey made in 1872-73 from the headquarters of the Indian Great Trigonometrical Survey by a semi-Thibetan, a young man trained to the work, named Major Montgomerie. He crossed the Brahmaputra to the north of Shigatze, and journeyed along the river Sheang Chu, to the lake Tengri-Nor (the local name of which is Namcho), which he may be said to have discovered, as it has hitherto been placed on our maps merely on the authority of old Chinese surveys of unknown authorship. Its north point is just under  $31^{\circ}$  N. lat., and its south point about  $30\frac{1}{2}^{\circ}$ ; it lies between  $30^{\circ}$  and  $31^{\circ}$  west. It is about 50 miles in length and between 16 and 25 miles in breadth. After suffering considerable hardships the young explorer and his small party returned to Lhasa.

To the keepership of the Zoological collections of the British Museum, vacated by the resignation of Dr. J. E. Gray, Dr. Albert Günther has been appointed. The appointment of Assistant Keeper, rendered vacant by Dr. Günther's promotion, has been filled by the appointment of Mr. F. Smith, of the Entomological Department.

PROFS. CHIERICI, Pigorini, and Strobel, have started a new periodical devoted to the prehistoric antiquities of Italy, under the title of the *Bullettino di Paleontologia Italiana*, the first number of which has just appeared. It is intended to issue monthly numbers, each of sixteen pages, with at least six illustrative plates in the course of the year. The present number contains articles on flint flakes worked to a rhomboidal form like some of those discovered in Kent's Cavern, on the mode of hafting bronze celts, and notices of some recent discoveries in Italy. The annual subscription is seven francs.



WE would remind our readers that Prof. Clerk-Maxwell's lecture to the Chemical Society, "On the dynamical evidence of the molecular constitution of bodies," will be delivered on Thursday next, the 18th instant. The Faraday Lecture will be delivered by Dr. A. W. Hofmann on the 18th of March.

THE Cambridge Smith's Prizes have been adjudged as follows:—First prize, W. Burnside, B.A., Pembroke; second prize, G. Chrystal, B.A., St. Peter's. These two gentlemen were declared equal in the last Mathematical Tripos as Second Wrangler.

AT the 300th anniversary of the founding of the University of Leyden, held on the 8th inst., degrees were conferred on the following English men of science:—Prof. Cayley, Mr. Huggins, Mr. Prescott Joule, Dr. Odling, and also Prof. Newcomb, of Washington, U.S., created Doctors of Mathematics and Physics. Mr. Charles Darwin was created Doctor of Medicine.

It is intended to issue, in October 1875, the first number of a periodical to be entitled *Mind*; a *Quarterly Review of Scientific Psychology and Philosophy*. Due prominence will be given in the Review to objective researches into the functions of the nervous system. All special lines of investigation affording insight into mind, in dependence on the main track of psychological inquiry, will receive attention in the Review; e.g., Language, Primitive Culture, Mental Pathology, and Comparative Psychology. *Mind* will be published by Messrs. Williams and Norgate.

THE Board of Trinity College, Dublin, have elected Dr. J. Emerson Reynolds Professor of Chemistry in the University of Dublin. Dr. Reynolds is well known as an accomplished chemist, an excellent observer, and a skilful experimentalist. His researches on a new group of colloid bodies containing mercury, and on certain silicic acids, and his discovery of sulphuretted urea, have made his name well known. His election as one of the Professors of the Medical School of Dublin University is in every way for the interest of that school, and the announcement thereof will be received with the greatest favour by his colleagues.

THERE will be an examination at Downing College, on Tuesday, April 6, and three following days, for a Scholarship in Natural Science. Information can be obtained of the tutor of the College, Mr. John Perkins.

THE Government has received a despatch from Batavia, dated Feb. 3, announcing an eruption of the volcano Kloeet, in the island of Java, whereby great destruction has been caused at Blitar.

WE have received an instalment of the thirty-ninth supplement to Petermann's *Mittheilungen*, which is to be occupied with a full geographical and statistical account of the Argentine Republic, Chili, Paraguay, and Uruguay. The part to hand contains details concerning the physical features, political divisions, and population of the first-named, and a large finely executed map of all the four. Dr. Petermann himself compiles the strictly geographical account from the latest official statistics, while a geographico-statistical appendix is to be given by Dr. Burmeister, director of the Museum of Buenos Ayres.

THE January part of Petermann's *Mittheilungen* contains a very interesting sketch, by E. Behm, of the origin and progress of the German African Society, which has already set to work in earnest on the West Coast, and promises to do much for the exploration of Africa in this direction. Dr. Petermann writes on the means by which the Society's explorers are to carry on their work, and strongly advocates the use of elephants. A map of the coast from 2° N. to 10° S. accompanies the papers, showing the routes of previous explorers, and those of Bastian, Güssfeldt, and Lenz,

in 1873-74. The moving spirit of the Society is the accomplished Dr. Bastian, who himself has travelled in nearly every region of the globe.

THE January number of the *Bulletin* of the French Geographical Society contains the first instalment of a series of extracts from Abbé David's account of his travels in Mongolia in 1866. Abbé David is one of the most indefatigable of living travellers, and has probably done more than any other explorer to make known the natural history of China; for it is for botanical and zoological, rather than for geographical purposes, he travels. The narrative of this his first journey, and also of his second in 1868-70, up the Yang-tse-Kiang, and as far as the borders of Thibet, have been published in the *Nouvelles Archives* of the Paris Museum. From these narratives the present extracts, presenting mainly the geographical results, are taken. Abbé David was compelled to return to Europe last April to recruit his shattered health, and contemplates publishing a separate narrative of a third journey, from Peking down through the centre of China, during which he explored the important chain of the Tsing-ling Mountains.

AT the last *soirée* of the Paris Observatory M. Dupuy de Lome explained his ferry-boat intended to carry railway trains between England and France. M. de Lesseps also delivered a lecture on the tunnel which it is proposed to bore from Calais to Dover. A commission of nineteen members has been elected by the Versailles Assembly to report upon the boring of a preliminary gallery. All the members are unanimous to grant the required authorisation. The president of the commissioners is M. Martel, one of the members for Pas de Calais. Four other members for that department are amongst the commission.

ON the 1st of February M. Leverrier announced to the Academy of Sciences the discovery, by M. Stéphan, the director of the Marseilles Observatory, of Encke's comet. On the 8th he announced the detection, by M. Stéphan, of Winnecke's comet, which is a more notable object, and can be observed with a finder. It is necessary to employ powerful instruments to see Encke's with certainty. Both comets were seen at Marseilles for the first time, that of Encke in 1818, and Winnecke in 1819.

IN the number of the 30th January of the *International Bulletin of the Paris Observatory*, M. Leverrier publishes the first list of the corrected observations for the small planets in 1873. Almost all the numbers are incorrect by a few tenths of a second, many of one second, some of twenty seconds, and one of two degrees.

THE Statistical Society have published this year for the first time an almanac for 1875. It is very neatly got up, and will no doubt prove useful to the members of the Society; and the very carefully and originally arranged calendar ought to make it interesting to outsiders. The almanac contains, besides, a list of the principal statistical documents issued by the several State departments, and a series of tables of equivalents of imperial and metric weights and measures. During the year 1875 the Council hope to make arrangements for compiling *Tables of Constants* relating to population, pauperism, crime, education, exports and imports, &c., with a view to their publication with the almanac for 1876.

THE following is the title of the essay to which the Howard Medal will be awarded by the Statistical Society in November 1875; the essays to be sent in on or before June 30, 1875:—  
"The State of the Dwellings of the Poor in the Rural Districts of England, with special regard to the Improvements that have taken place since the middle of the 18th century; and their Influence on the Health and Morals of the Inmates."

THE South Park Commissioners of Chicago have recently determined upon the establishment of botanical gardens in the

park, and have set apart for the purpose a tract of sixty acres, to which additions will be made from time to time as occasion may require. A botanical museum and herbarium will be included in the scheme. A circular has been issued by the board of managers, soliciting contributions from kindred institutions. The works are to be commenced as soon as the weather will permit.

It may be remembered that the United States steamer *Tuscarora*, after having completed the line of soundings made for the purpose of selecting a suitable route for a Transpacific cable, under Commander Belknap, again started on the same duty, under the charge of Capt. Erben, leaving San Francisco on the 1st of November direct for the Sandwich Islands. The *Hawaiian Gazette* of Dec. 2 announces her arrival at Honolulu, and remarks that, in all, sixty-two casts of the sounding-line were made, the first near the Farallones, the water gradually deepening from that point to 2,500 fathoms. In lat.  $33^{\circ} 10'$  and long.  $132^{\circ}$  the depth began rapidly to diminish, showing 1,417, 435, 413, and, finally, 385 fathoms in lat.  $32^{\circ} 58'$ . Numerous observations were made, which showed that there was a submarine peak rising about 2,200 fathoms from the ocean bed. Beyond this, for a circuit of five miles around this peak, deep water was found in every direction, and a few miles from the peak 2,500 fathoms were reached. From this the depth gradually increased, until in lat.  $24^{\circ}$  long.  $152^{\circ}$  the depth was 3,115 fathoms. This was only about 400 miles from Honolulu. The soundings brought up from the peak showed a mixture of lava and coral, which is supposed to be indicative of a submarine volcano. The temperature at the bottom was found to vary but little from  $35^{\circ}$  to  $36^{\circ}$  F. The results of the survey, according to the *Gazette*, are satisfactory, showing, if anything, a better line between Honolulu and San Francisco than that from San Diego.

THE science of medicine and surgery according to European notions is making some progress in Japan. We learn that in the hospital at Hakodadi there are twenty young men regularly entered as students of medicine, daily lectures are given, and "bedside and other clinical demonstrations," the curriculum being similar to that of most medical schools. An illustrated medical journal in the Japanese language is also published every two months.

FROM the Superintendent's Report (1874) it appears that the Royal Botanic Gardens, Calcutta, are recovering very slowly from the devastating effects of the cyclones of 1864 and 1867. The growth of the shrubs and trees planted to replace those uprooted has not been very luxuriant, and a long time must elapse before the welcome and useful shade of noble trees such as once filled the garden will be enjoyed there again.

THE additions to the Zoological Society's Gardens during the past week include four Summer Ducks (*Aix sponsa*) from N. America, presented by Lord Braybrook, F.Z.S.; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Pole Shawe; a Zebu (*Bos indicus*) born in the Menagerie; a White-fronted Capuchin Monkey (*Cebus albifrons*) from S. America, deposited; two Indian Tree Ducks (*Dendrocygna arcuata*) from India, received in exchange; fourteen Basse (*Labrax lupus*), three Grey Mullet (*Mugil capito*), and a Cottus, (*Cottus bubalis*) from British Seas, purchased.

### SCIENTIFIC SERIALS

*Der Zoologische Garten*.—In the December number the first article is one on monstrosities in wild birds, by Herr Pfarrer Jäckel, who describes several instances of additional and deficient limbs, and figures the leg of a Golden Eagle with two well-developed extra toes attached to the back of the tarsus.—The editor, Dr. Noll, treats of the salmon-fishery on the Rhine at

St. Goar. In 1873 the number of fish captured was 1,162, weighing in all 16,612 lbs.—An account by Dr. Taiber of the chase of the South American Ostrich (*Rea americana*) with the *bolos* is reproduced from the "La Plata Monatsschrift."—Dr. R. Meyer describes two breeding nests of the squirrel (*Sciurus vulgaris*), in which the entrance was covered by a lid or flap, formed of fine grass; he confirms the statement that these animals have other nests to which they remove their young in case of danger.—Dr. A. Praetorius writes on the domestic animals of the ancient Greeks.—Victor Ritter von Tschusi-Schmidhofen states, on the authority of L. v. Hueber, that the Lesser Kestrel (*Tinnunculus cenchris*) is spreading northward in Carinthia, and replacing the common species (*T. alandarius*), and also gives an instance of the breeding of the Waxwing (*Bombicilla garrula*) in Austria, a nest having been found in May 1872, in the Castle park at Kremsier by Pfarrer Kaspar. Unfortunately, it was destroyed, and the birds disappeared.

*Journal of the Asiatic Society of Bengal*, Part II. No. 2, 1874.—Record of the Khairpur meteorite of Sept. 23, 1873, by H. B. Medlicott. This is simply a record of the appearance and fall of a meteorite, from the observations of several persons, and the weights of the specimens collected, the largest of which weighed 10 lb. 12 oz. 126 gr. The stone is described as being of the usual steel-grey colour and crypto-crystalline texture.—Contributions towards a knowledge of the Burmese Flora, Part I., by S. Kurz: an abridged enumeration of Burmese plants, phanerogamic and cryptogamic, as far as they have come to the writer's knowledge, containing the polypetalous dicotyledons, Ranunculaceæ to the end of the Geraniaceæ. Epitomised generic descriptions are given, as well as a conspectus of the species of each genus.—On the Asiatic species of Molossi, by G. E. Dobson. Two new species are described, viz., *Nyctinomus tragatus* and *N. johorensis*.—Index to Part II. vol. xlii., 1873.

*Astronomische Nachrichten*, No. 2,018.—This number contains a long article detailing observations of the spectra of Winnecke's and Coggia's comets, and of changes in the head of that of Coggia. As to the spectrum of Winnecke's comet, the author states that on the 7th and 10th of May last the spectrum consisted of three bright bands, the middle one the brightest, and sharply limited towards the red end of the spectrum. The brightest portion of this band appeared a little more refrangible than the  $b_4$  line, while the beginning of the band coincided with it. The bright central portion of the comet,  $1\frac{1}{2}'$  diameter, appeared to have in it certain bright points like stars of 12 to 14 magnitude, and the central portion gave a faint continuous spectrum. On the 6th of May, Coggia's comet gave a spectrum of three bands: the central one near  $b$  line was brightest, and the one nearest the blue the faintest; the nucleus and contiguous portions gave a continuous spectrum, in addition to the former one, extending from wavelength 590 to 440. On the 18th the middle line was seen sharply limited towards the red and shading towards the blue; the wavelength of the sharp limit was estimated at 515; the other bands were not so sharply defined on the red side as the central one, and the relative brightness of each is given as yellow, 2; green, 4; and blue, 1. The bands were strongest where crossed by the continuous spectrum of the nucleus. No other bands were visible; the positions of the commencement of the bands from a mean of observations are, 1st band, 562.5; 2nd band, 515.1; and 3rd band, 471.6. A change in the comparative brightness of the bands appears to have been noticed at times, and the author observes that one might expect absorption bands in the continuous spectrum corresponding to the bright bands, and that the changes of brightness of the lines should be viewed as an important matter in reference to this expectation. Traces of absorption bands appear to have been noticed, but their position not fixed. The following table of comparison of spectra of comets and hydrocarbons is given:—

		Comet. Coggia.	Comet. Henry.	Comet II. 1868.
First band	Beginning ...	562.5	562.6	563.1
	of Brightest part ...	553.8	559	—
Spectrum.	End ...	541	541	538
	Beginning ...	515.1	517.1	517.2
Second ditto.	Brightest part ...	511.8	516	—
	End ...	500	500	492
Third ditto.	Beginning ...	471.6	472.7	471.4
	Brightest part ...	468.9	466	—
	End ...	465	464	458